

Docket No.: 020732-100.686
Appl. No.: 10/724,791

Section I. (The Claims)

1. (Currently Amended) An etching composition[[,]] consisting essentially of a supercritical fluid (SCF), at least one co-solvent, and at least one etchant species, wherein the co-solvent consists of at least one straight-chain or branched C₁-C₆ alcohol and the etchant species comprises ~~comprises~~ consists of at least one bifluoride compound selected from the group consisting of ammonium bifluoride and tetraalkylammonium bifluoride ((R)₄NHF₂), wherein R is a C₁-C₄ alkyl group and said composition is adapted for etching a sacrificial silicon-containing layer on a substrate.

2. (Cancelled)

3. (Cancelled)

4. (Cancelled)

5. (Currently Amended) The composition of claim 1, wherein the co-solvent consists of ~~comprises~~ methanol.

6. (Currently Amended) The composition of claim 1, wherein the co-solvent consists of ~~comprises~~ isopropanol.

7. (Previously presented) The composition of claim 1, wherein the sacrificial silicon-containing layer comprises silicon oxide.

8. (Cancelled)

9. (Currently Amended) The composition of claim 1, wherein the etchant species consists of ~~comprises~~ ammonium bifluoride.

10. (Cancelled)

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11. (Currently Amended) The composition of claim 1, further ~~comprising~~ consisting of at least one non ionic surfactant, wherein the surfactant is selected from the group consisting of fluoroalkyl surfactants, polyethylene glycols, polypropylene glycols, polyethylene ethers, polypropylene glycol ethers, carboxylic acid salts, dodecylbenzenesulfonic acid, dodecylbenzenesulfonic salts, polyacrylate polymers, dinonylphenyl polyoxyethylene, silicone polymers, modified silicone polymers, acetylenic diols, modified acetylenic diols, alkylammonium salts, modified alkylammonium salts, and combinations consisting of ~~comprising~~ at least one of the foregoing.

12. (Currently Amended) The composition of claim 11, wherein the surfactant consists of ~~comprises~~ a modified acetylenic diol.

13. (Currently Amended) The composition of claim 11, wherein the etching composition consists of ~~comprises~~ about 75.0 wt % to about 99.5 wt % SCCO₂, about 0.3 wt % to about 22.5 wt % co-solvent, about 0.01 wt % to about 5.0 wt % etchant species, and about 0.01 wt % to about 5.0 wt % surfactant, based on the total weight of the composition.

14. (Previously presented) The composition of claim 1, wherein the sacrificial silicon-containing layer consists essentially of silicon.

15.-16. (Cancelled)

17. (Withdrawn) A method of removing silicon-containing substances from a substrate having same thereon, said method comprising contacting the substrate with a SCF-based composition consisting ~~essentially~~ of SCF, at least one co-solvent, and at least one etchant species, for sufficient time and under sufficient contacting conditions to remove the silicon-containing substances from the substrate, wherein the co-solvent consists of at least one straight-chain or branched C₁-C₆ alcohol and the etchant species ~~comprises~~ consists of at least one bifluoride compound selected from the group consisting of ammonium bifluoride and tetraalkylammonium bifluoride ((R)₄NHF₂), wherein R is a C₁-C₄ alkyl group.

18. (Cancelled)

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19. (Cancelled)
20. (Withdrawn) The method of claim 17, wherein the contacting conditions comprise pressures in a range of from about 1400 to about 4400 psi.
21. (Withdrawn) The method of claim 17, wherein said contacting time is in a range of from about 30 seconds to about 30 minutes.
22. (Cancelled)
23. (Withdrawn) The method of claim 17, wherein the co-solvent consists of ~~comprises~~ methanol.
24. (Withdrawn) The method of claim 17, wherein the co-solvent consists of ~~comprises~~ isopropanol (IPA).
25. (Withdrawn) The method of claim 17, wherein the silicon-containing substance comprises a sacrificial silicon oxide layer.
26. (Cancelled)
27. (Withdrawn) The method of claim 17, wherein the etchant species consists of ~~comprises~~ ammonium bifluoride.
28. (Cancelled)
29. (Withdrawn) The method of claim 17, further consisting of ~~comprising~~ at least one non ionic surfactant, wherein the surfactant is selected from the group consisting of fluoroalkyl surfactants, polyethylene glycols, polypropylene glycols, polyethylene ethers, polypropylene glycol ethers, carboxylic acid salts, dodecylbenzenesulfonic acid, dodecylbenzenesulfonic salts, polyacrylate polymers, dinonylphenyl polyoxyethylene, silicone polymers, modified silicone

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polymers, acetylenic diols, modified acetylenic diols, alkylammonium salts, modified alkylammonium salts, and combinations consisting of ~~comprising~~ at least one of the foregoing.

30. (Withdrawn) The method of claim 29, wherein the etching composition consists of ~~comprises~~ about 75.0 wt % to about 99.5 wt % SCCO_2 , about 0.3 wt % to about 22.5 wt % co-solvent, about 0.01 wt % to about 5.0 wt % etchant species, and about 0.01 wt % to about 5.0 wt % surfactant, based on the total weight of the composition.

31. (Withdrawn) The method of claim 17, wherein the silicon-containing substance is selected from the group consisting of silicon, post-ash residue and post-etch residue.

32. (Cancelled)

33. (Withdrawn) The method of claim 31, further comprising dehydrating the substrate prior to contacting the substrate with the SCF-based etching composition.

34. (Cancelled)

35. (Withdrawn) The method of claim 17, wherein the contacting step comprises an etching cycle including (i) dynamic flow contacting of the etching composition with the silicon-containing substance, and (ii) static soaking contacting of the etching composition with the silicon-containing substance.

36. (Withdrawn) The method of claim 35, wherein said etching cycle comprises alternately and repetitively carrying out dynamic flow contacting (i) and static soaking contacting (ii) of the silicon-containing substance.

37. (Withdrawn) The method of claim 17, further comprising the step of washing the substrate, at a region at which the silicon-containing substance has been removed, with a SCF/methanol/deionized water wash solution in a first washing step, and with a SCF in a second washing step, to remove residual precipitated chemical additives in said first washing step, and to

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remove residual precipitated chemical additives and/or residual alcohol in said second washing step.

38. (Withdrawn) The method of claim 37, wherein the SCF is SCCO_2 .

39. (Currently Amended) An etching composition consisting essentially of a supercritical fluid, at least one co-solvent, at least one bifluoride compound, and at least one non ionic surfactant, wherein the co-solvent consists of at least one straight-chain or branched $\text{C}_1\text{-C}_6$ alcohol and the at least one bifluoride compound consists of ~~comprises~~ a species selected from the group consisting of ammonium bifluoride and tetraalkylammonium bifluoride $((\text{R})_4\text{NHF}_2)$, wherein R is methyl, ethyl, butyl, phenyl or fluorinated $\text{C}_1\text{-C}_4$ alkyl groups and said composition is adapted for etching a sacrificial silicon-containing layer on a substrate.

40. (Cancelled)

41. (Previously Presented) The composition of claim 1, wherein the SCF is selected from the group consisting of carbon dioxide, oxygen, argon, krypton, xenon, and ammonia.

42. (Previously Presented) The composition of claim 1, wherein the SCF is carbon dioxide.

43. (Withdrawn) A method of producing Micro Electro Mechanical Systems (MEMS) devices, wherein said MEMS device comprises a substrate and a structural layer, said method comprising contacting the substrate with the SCF-based composition of claim 1, for sufficient time and under sufficient contacting conditions to remove a sacrificial silicon-containing substance from the substrate.